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FORM 9-6.1

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Practitioner's Docket No. 01-2580A

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: SHAO-HUA GUO ET AL.
Application No.: 09 / 934,878 Group No.: 1621
Filed: AUGUST 22, 2001 Examiner: ELVIS O. PRICE
For: PREPARATION OF ACRYLIC POLYOLS

MAIL STOP APPEAL BRIEF - PATENTS
COMMISSIONER FOR PATENTS
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TRANSMITTAL OF APPEAL BRIEF
(PATENT APPLICATION—37 C.F.R. § 1.192)

1. Transmitted herewith, in triplicate, is the APPEAL BRIEF in this application, with respect to the Notice of Appeal filed on 9/26/2003

NOTE: "Appellant must, within two months from the date of the notice of appeal under § 1.191 or within the time allowed for reply to the action from which the appeal was taken, if such time is later, file a brief in triplicate. . . . " 37 C.F.R. § 1.192(a) (emphasis added).

2. STATUS OF APPLICANT

This application is on behalf of

- ☒ other than a small entity.
☐ a small entity.

A statement:

- ☐ is attached.
☐ was already filed.

3. FEE FOR FILING APPEAL BRIEF

Pursuant to 37 C.F.R. § 1.17(c), the fee for filing the Appeal Brief is:

- | | |
|---|----------|
| <input type="checkbox"/> small entity | \$150.00 |
| <input checked="" type="checkbox"/> other than a small entity | \$330.00 |

Appeal Brief fee due \$ 330.00

CERTIFICATE OF MAILING/TRANSMISSION (37 C.F.R. § 1.8(a))

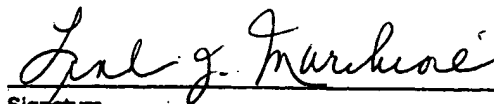
I hereby certify that this correspondence is, on the date shown below, being:

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☒ deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to the COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA 22313-1450, ON NOVEMBER 24, 2003.

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Date: 11/24/2003

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4. EXTENSION OF TERM

NOTE: The time periods set forth in 37 C.F.R. § 1.192(a) are subject to the provision of § 1.136 for patent applications. 37 C.F.R. § 1.191(d). See also Notice of November 5, 1985 (1060 O.G. 27).

NOTE: As the two-month period set in § 1.192(a) for filing an appeal brief is not subject to the six-month maximum period specified in 35 U.S.C. § 133, the period for filing an appeal brief may be extended up to seven months. 62 Fed. Reg. 53,131, at 53,156; 1203 O.G. 63, at 84 (Oct. 10, 1997).

The proceedings herein are for a patent application and the provisions of 37 C.F.R. § 1.136 apply.

(complete (a) or (b), as applicable)

- (a) ☐ Applicant petitions for an extension of time under 37 C.F.R. § 1.136 (fees: 37 C.F.R. § 1.17(a)(1)-(5)) for the total number of months checked below:

Extension (months)	Fee for other than small entity	Fee for small entity
<input type="checkbox"/> one month	\$ 110.00	\$ 55.00
<input type="checkbox"/> two months	\$ 380.00	\$ 190.00
<input type="checkbox"/> three months	\$ 870.00	\$ 435.00
<input type="checkbox"/> four months	\$ 1,360.00	\$ 680.00
<input type="checkbox"/> five months	\$ 1,850.00	\$ 925.00

Fee: \$ _____

If an additional extension of time is required, please consider this a petition therefor.

(check and complete the next item, if applicable)

- ☐ An extension for _____ months has already been secured, and the fee paid therefor of \$ _____ is deducted from the total fee due for the total months of extension now requested.

Extension fee due with this request \$ _____

or

- (b) ☐ Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

5. TOTAL FEE DUE

The total fee due is:

Appeal brief fee \$ 330.00

Extension fee (if any) \$ _____

TOTAL FEE DUE \$ 330.00

6. FEE PAYMENT

☐ Attached is a check in the sum of \$ _____

☒ Charge Account No. 01-2230 the sum of \$ 330.00

A duplicate of this transmittal is attached.

(Transmittal of Appeal Brief [9-6.1]—page 2 of 3)

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**7. FEE DEFICIENCY**

NOTE: If there is a fee deficiency and there is no authorization to charge an account, additional fees are necessary to cover the additional time consumed in making up the original deficiency. If the maximum six-month period has expired before the deficiency is noted and corrected, the application is held abandoned. In those instances where authorization to charge is included, processing delays are encountered in returning the papers to the PTO Finance Branch in order to apply these charges prior to action on the cases. Authorization to change the deposit account for any fee deficiency should be checked. See the Notice of April 7, 1986, 1065 O.G. 31-33.

- ☐ If any additional extension and/or fee is required, this is a request therefor and to charge Account No. _____

AND/OR

- ☒ If any additional fee for claims is required, charge
Account No. 01-2230

SIGNATURE OF PRACTITIONER

Reg. No.: 44,728

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DEC 05 2003

TECH CENTER 1600/2900

Applicant(s) : Shao-Hua Guo et al.
Application Number : 09/934,878
Filed : August 22, 2001
Title : PREPARATION OF ACRYLIC POLYOLS
Group Art Unit : 1621
Examiner : Elvis O. Price
Docket No. : 01-2580A

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPEAL BRIEF UNDER 37 C.F.R. § 1.192(d)

I. REAL PARTY IN INTEREST

The real party in interest is Arco Chemical Technology, L.P.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Applicants, their representatives, or their assignee that will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1, 3-11, and 14-18 are on appeal.

IV. GROUPING OF CLAIMS

The claims on appeal shall stand or fall together.

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V. STATUS OF AMENDMENTS

Claims on appeal have been amended after the Final Office Action for minor corrections. The amendments have been entered by the Examiner in the Advisory Action.

VI. SUMMARY OF THE INVENTION

The invention is a process for making acrylic polyols by free radically copolymerizing an alkoxyated allyl alcohol with alkyl acrylate or methacrylate. The process is performed in essentially the absence of styrene, methyl acrylate, methyl methacrylate, and allyl alcohol.

Contrary to the common belief in the art that polymerization of allyl monomers cannot reach a high monomer conversion due to their *degradative chain transfer*, Applicants' process gives a monomer conversion of 90% or greater as a result of using essentially no styrene, no methyl acrylate, and no methyl methacrylate, and using alkoxyated allyl alcohol rather than allyl alcohol.

VII. QUESTION PRESENTED FOR REVIEW

Whether Applicants' invention is obvious over U.S. Pat. No. 5,475,073 (*Guo*) in view of U.S. Pat. No. 6,127,500 (*Guo et al.*), and further in view of the *Aldrich* catalog, while the combination of the references fails to teach or suggest all claim limitations, fails to provide any suggestion or motivation to modify the references to make the invention, and fails to provide any reasonable expectation of success of the invention.

VIII. ARGUMENTS

Applicants contend that there is no *prima facie* case of obviousness for the present claims over *Guo* in view of *Guo et al.* and further in view of the *Aldrich* catalog. MPEP §2142 provides

“To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.”

Applicants respectfully ask the Honorable Board to review and reverse the Examiner’s obviousness rejection because none of these three requirements provided by MPEP §2142 is satisfied by the rejection.

(I) All Claim Limitations Must Be Taught or Suggested

To establish a *prima facie* case of obviousness, the Examiner must consider all claim limitations. MPEP §2143.03 provides that “To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art.” *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). The Examiner’s rejection must be reversed because the combined references do not teach or suggest all the limitations of the claims.

Two essential limitations of Applicants’ claims were ignored by the Examiner: (1) the process of the invention is conducted essentially in the absence of styrene, methyl acrylate and methyl methacrylate; and (2) the process excludes the use of allyl alcohol. These two limitations cannot be found from *Guo*, *Guo et al.*, or the *Aldrich* catalog, or any combinations thereof.

Applicants have provided ample evidence in the application which shows that when these conditions are met, the process achieves a high monomer conversion (90 % or greater) and otherwise, the process gives a much lower monomer conversion. For

instance, the polymerization of allyl alcohol monopropoxylate and n-butyl acrylate in the absence of styrene gives an almost complete monomer conversion (Example 1: 99.5% conversion). However, the same polymerization in the presence of styrene gives only 88.8% of monomer conversion (Comparative Example 3).

Unlike the present invention, *Guo* and *Guo et al.* teach the use of styrene, methyl acrylate or methacrylate, and allyl alcohol in the process. As discussed above, the reference process gives a monomer conversion that is considerably lower than that of the present invention. The *Aldrich* catalog is not even relevant here because it provides no helpful information in this regard.

In summary, Applicants respectfully ask the Honorable Board to reverse the obviousness rejection because the combined teachings of the references neither teach nor suggest two essential claim limitations: (1) the process of the invention is conducted essentially in the absence of styrene, methyl acrylate and methyl methacrylate; and (2) the process excludes the use of allyl alcohol, while these two elements are essential to achieve an substantially increased monomer conversion of the process.

(II) Suggestion or Motivation to Modify the References

The Examiner has two essential contentions with regard to the motivation to modify the references. First, the Examiner contends: since *Guo* teaches a process for preparing acrylic polyols which encompasses the process conditions of the present invention (e.g., the reaction temperature, type and amount of monomer used, type of initiator, etc.), a reasonable artisan will be motivated by *Guo* to make the present invention. Second, the Examiner contends: even if *Guo* itself is not enough to motivate a reasonable artisan to make the present invention, *Guo et al.* teaches that the acrylic polyols made in *Guo* are valuable materials, and this teaching will motivate a reasonable artisan to modify the *Guo* process. These contentions are inconsistent with MPEP §2143.01 and therefore they must fall.

MPEP §2143.01 instructs that "A statement that modifications of the prior art to meet the claimed invention would have been " 'well within the ordinary skill of the art at the time the claimed invention was made' " because the references relied upon teach that

all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references.”

According to the Examiner, because *Guo* teaches a process for making acrylic polyols, a reasonable artisan will be motivated by *Guo* to conduct the polymerization in the absence of styrene, methyl acrylate (or methacrylate), and allyl alcohol in order to increase the monomer conversion regardless of the fact that *Guo* specifically teaches the use of these monomers. According to the Examiner, because *Guo* teaches that the reaction temperature can be up to 300°C, a reasonable artisan will be motivated to conduct the reaction at a reflux condition. According to the Examiner, because *Guo*’s material is valuable, any improvement of the material would be obvious. Following the Examiner’s reasoning, no inventions after *Guo* in the area of making acrylic polyols from allylic monomers would be possibly patentable.

According to the instruction of MPEP §2143.01, the Examiner must provide some objective reason to modify the teachings of the references. The Examiner has failed to do so. Thus, Applicants respectfully ask the Honorable Board to reverse the rejection.

(III) Reasonable Expectation of Success

Applicants respectfully ask the Honorable Board to review and reverse the Examiner’s obviousness rejection also because the Examiner fails to satisfy the second requirement of MPEP §2142: the combined teachings of the references must provide a reasonable expectation of success.

As Applicants discussed in the Background of the Invention, making acrylic polyols from allylic monomers is difficult because of low monomer conversion. Removing and recycling unreacted monomers is inconvenient and costly. *See the application, page 2, lines 16-19.* The problem of low monomer conversion of allylic polymerization is well recognized in the art and is commonly believed to be resulted from the *degradative chain transfer* of allylic monomers. *See “Principles of Polymerization” by George Odian, pages 250-251 (attached).*

The combined teachings of *Guo*, *Guo et al.* and the *Aldrich* catalog provide no hint that the process of the present invention would have any chance of success to achieve a monomer conversion greater than 90%. In fact, *Guo* teaches the opposite. In *Guo*'s Example 1, allyl alcohol, methyl methacrylate and 2-ethylhexyl acrylate are polymerized; the total monomer conversion is only 67.9%. In *Guo*'s Example 2, allyl alcohol, styrene, n-butyl methacrylate and n-butyl acrylate are polymerized; the total monomer conversion is only 75.8%. In *Guo*'s Example 3, allyl alcohol, t-butyl acrylate and n-butyl acrylate are polymerized; the total monomer conversion is only 70%. In *Guo*'s Example 4, allyl monopropoxylate and methyl methacrylate are polymerized; the total monomer conversion is only 80.7%. In *Guo*'s Example 5, allyl monopropoxylate, 2-ethyl acrylate and methyl methacrylate are polymerized; the total monomer conversion is only 72.4%. These monomer conversions are well below what Applicants claim: 90% or greater.

Therefore, Applicants respectfully ask the Honorable Board to reverse the obviousness rejection under the second requirement of MPEP §2142 because the combined teachings of the references provide no reasonable expectation of success of the present invention.

In conclusion, Applicants' claims are non-obvious. Accordingly, Applicants respectfully ask the Honorable Board to reverse the rejections and to allow claims 1, 3-11, and 14-18.

Respectfully submitted,
Shao-Hua Guo et al.

By: Shao-hua Guo

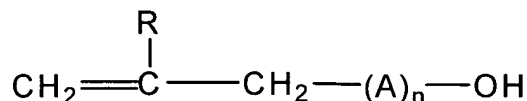
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11/24/2003
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Appendix**Claims on Appeal**

1. A process for making an acrylic polyol, said process being performed essentially in the absence of styrene, methyl acrylate and methyl methacrylate, and comprising:

- (a) initially charging a reactor with an allylic alcohol, 0-50% of the total amount to be used of a C₂-C₂₀ alkyl or aryl acrylate or methacrylate monomer and 0-100% of the total amount to be used of a free-radical initiator;
- (b) heating the reactor contents to a temperature within the range of 100-250°C; and
- (c) gradually adding to the reactor the remaining acrylic monomer and initiator;

wherein the allylic alcohol has the general structure:

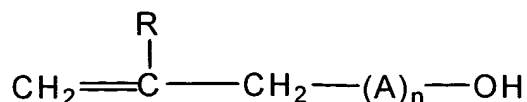


in which R is hydrogen, a C₁-C₁₀ alkyl, or a C₆-C₁₂ aryl group; A is an oxyalkylene group; and n, which is an average number of oxyalkylene groups, is within the range of 1 to about 5; and wherein the process gives a total monomer conversion greater than about 90%.

3. The process of claim 1 having a total monomer conversion greater than about 95%.
4. The process of claim 1 having a total monomer conversion greater than about 99%.
5. The process of claim 1 wherein the acrylic polyol has a number average molecular weight less than about 5,000 and a weight average molecular weight less than about 10,000.

6. The process of claim 1 wherein the acrylic polyol has a number average molecular weight less than about 2,500 and a weight average molecular weight less than about 5,000.
7. The process of claim 1 wherein the acrylic polyol has a molecular weight distribution less than about 3.5.
8. The process of claim 1 wherein the acrylic polyol has a molecular weight distribution less than about 2.5.
9. The process of claim 1 wherein the liquid acrylic polyol has a hydroxyl number within the range of about 20 mg KOH/g to about 250 mg KOH/g.
10. The process of claim 1 wherein the acrylic monomer is a C₂-C₂₀ alkyl acrylate or methacrylate.
11. The process of claim 1 wherein the acrylic monomer is selected from the group consisting of 2-ethylhexyl acrylate, n-butyl acrylate, 2-ethylhexyl methacrylate, hexyl methacrylate, n-butyl methacrylate, isobornyl methacrylate, and mixtures thereof.
14. The process of claim 1 wherein n is within the range of about 1 to about 2.
15. The process of claim 1 wherein the allylic alcohol is allyl alcohol monopropoxylate.
16. A process for making an acrylic polyol, said process being performed at reflux temperature under atmospheric pressure, essentially in the absence of styrene, methyl acrylate and methyl methacrylate, and comprising:
 - (a) initially charging a reactor with an allylic alcohol, 0-50% of the total amount to be used of C₂ to C₂₀ alkyl or aryl acrylate or methacrylate and 0-100% of the total amount to be used of a free-radical initiator;
 - (b) heating the reactor contents to reflux; and
 - (c) gradually adding to the reactor the remaining acrylic monomer and initiator;

wherein the acrylic monomer has a boiling point the same as or higher than the allylic alcohol, wherein the allylic alcohol has the general structure:



in which R is hydrogen, a C₁-C₁₀ alkyl, or a C₆-C₁₂ aryl group; A is an oxyalkylene group; and n, which is an average number of oxyalkylene groups, is within the range of 1 to about 15; and wherein the process gives a total monomer conversion greater than about 90%.

17. The process of claim **16** having a total monomer conversion greater than about 95%.

18. The process of claim **17** wherein the free-radical initiator contains less than 30 wt % of water.



Principles of — Polymerization —

SECOND EDITION

George Odian

*Professor of Chemistry
The College of Staten Island
The City University of New York
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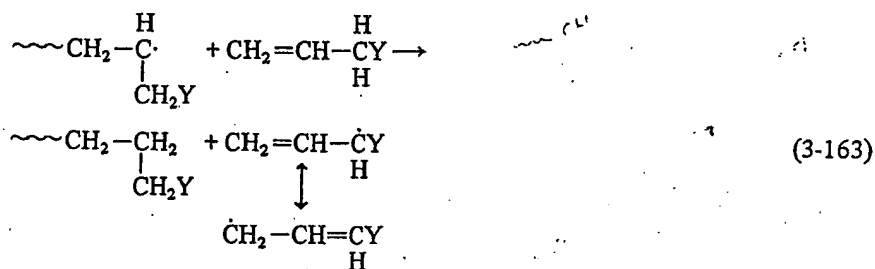
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oxygen [171]. Initiation probably occurs by thermal decomposition of the peroxides and hydroperoxides formed from the monomer (or, possibly more likely, from some impurity present in the system). Whether oxygen is an inhibitor or initiator will be highly temperature-dependent. Initiation will only occur at temperatures where the peroxides/hydroperoxides are unstable.

Other inhibitors include sulfur, carbon, aromatic azo compounds [172], and chlorophosphines [173].

3-7c Autoinhibition of Allylic Monomers

An especially interesting case of inhibition is the internal or *autoinhibition* of allylic monomers ($\text{CH}_2=\text{CH}-\text{CH}_2\text{Y}$). Allylic monomers such as allyl acetate polymerize at abnormally low rates with the unexpected dependence of the rate on the first power of the initiator concentration. Further, the degree of polymerization, which is independent of the polymerization rate, is very low—being only 14 for allyl acetate. These effects are the consequence of *degradative chain transfer* (Case 4 in Table 3-4). The propagating radical in such a polymerization is very reactive, while the allylic C—H (the C—H bond alpha to the double bond) in the monomer is quite weak—resulting in facile chain transfer to monomer



The weakness of the allylic C—H bond arises from the high resonance stability of the allylic radical which is formed. Degradative chain transfer competes exceptionally well with normal propagation and the polymer chains are terminated by transfer after the addition of only a very few monomer units. That the allylic C—H bond is the one broken in the transfer reaction has been shown [174] by experiments with $\text{CH}_2=\text{CH}-\text{CD}_2\text{OCOCH}_3$. The deuterated allyl acetate polymerizes 1.9–2.9 times as fast as normal allyl acetate and has a degree of polymerization 2.4 times as large under the same conditions. This is what would be expected since the C—D bond is stronger than the C—H bond due to its lower zero point energy and degradative chain transfer would therefore be decreased in the deuterated monomer.

The allylic radicals which are formed are too stable to initiate polymerization and the kinetic chain also terminates when the transfer occurs. The allylic radicals undergo termination by reaction with each other or, more likely, with propagating radicals [175]. Reaction 3-163 is equivalent to termination by an inhibitor, which is the monomer itself in this case. In this polymerization the propagation and termination reactions will have the same general kinetic expression with first-order

dependencies on initiator and monomer concentrations, since the same reactants and stoichiometry are involved. The degree of polymerization is simply the ratio of the rate constants for propagation and termination and is independent of the initiator concentration.

An alternate explanation is that allyl monomers are simply too low in reactivity to propagate extensively [176]. Data to support this mechanism are based on the low concentrations of allyl radicals observed by ESR relative to the concentrations of the propagating radicals. However, the overwhelming kinetic data support the degradative chain transfer mechanism.

The low reactivity of α -olefins such as propylene or of 1,1-dialkyl olefins such as isobutylene toward radical polymerization is probably a consequence of degradative chain transfer with the allylic hydrogens. It should be pointed out, however, that other monomers such as methyl methacrylate and methacrylonitrile, which also contain allylic C-H bonds, do not undergo extensive degradative chain transfer. This is due to the lowered reactivity of the propagating radicals in these monomers. The ester and nitrile substituents stabilize the radicals and decrease their reactivity toward transfer. Simultaneously the reactivity of the monomer toward propagation is enhanced. These monomers, unlike the α -olefins and 1,1-dialkyl olefins, yield high polymers in radical polymerizations.

3-8 DETERMINATION OF ABSOLUTE RATE CONSTANTS

3-8a Non-Steady-State Kinetics

There are five different types of rate constants that are of concern in radical chain polymerization—those for initiation, propagation, termination, chain transfer, and inhibition. The use of polymerization data under steady-state conditions allows the evaluation of only the initiation rate constant k_d (or k_t for thermal initiation). The ratio $k_p/k_t^{1/2}$ or k_p^2/k_t can be obtained from Eq. 3-25, since R_p , R_t , and $[M]$ are measurable. Similarly, the chain transfer constant k_{tr}/k_p and the inhibition constant k_z/k_p can be obtained by any of several methods discussed. However, steady-state data do not allow the evaluation of the individual k_p , k_t , k_{tr} , and k_z values. It is necessary to employ non-steady-state conditions to determine these individual rate constants. The treatment discussed here, for a photochemical polymerization, is essentially that of Flory [177] and Walling [133].

Radicals are generated abruptly by "putting on" the light source. The rates of initiation and termination are given by Eqs. 3-58 and 3-23, respectively. The rate of change of the radical concentration is given by the difference of their rates of production and termination

$$\frac{d[M\cdot]}{dt} = 2\phi I_a - 2k_t[M\cdot]^2 \quad (3-164)$$

For steady-state conditions $d[M\cdot]/dt$ is zero and